DOE/RL-2002-02
Revision 0

Application for Risk-Based Disposal Approval for Polychlorinated Biphenyls

Hanford 200 Area Liquid Waste Processing Facilities

Prepared for the U.S. Department of Energy
Assistant Secretary for Environmental Management
Project Hanford Management Contractor for the
U.S. Department of Energy under Contract DE-AC06-96RL13200

United States Department of Energy
P.O. Box 550
Richland, Washington 99352

Approved for public release; further dissemination unlimited

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R.W. Szelmeczka
Fluor Hanford

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Executive Summary

This application for risk-based disposal approval is provided to the U.S. Environmental Protection Agency for review and approval. The U.S. Department of Energy's Liquid Waste Processing Facilities at the Hanford Site provide a robust, effective system for treating polychlorinated biphenyls (PCB). Those facilities are presently restricted to receipt of only very small concentrations of PCBs (0.5 μg/L) in aqueous waste streams. Approval of this application will allow the facilities to operate as treatment units under the Toxic Substances Control Act and to accept aqueous waste streams with significantly higher levels of PCBs. This risk evaluation contains the technical basis for raising the concentration of PCBs that can be received by the Liquid Waste Processing Facilities.

The "Hanford PCB Framework Agreement", dated August 31, 2000, requires the U.S. Department of Energy to pursue the risk-based disposal approval for management of PCB remediation waste at the tank farms and at upstream and downstream facilities associated with the tank farms. A PCB risk assessment was recently completed for the Hanford Site Double-Shell Tank System and the methodologies for that assessment are incorporated in this risk evaluation, to the extent practicable.

This risk evaluation addresses risks posed by PCBs in the air pathway to Hanford Site workers, the public, and ecological receptors. The evaluation is comprised of detailed modeling of PCB emissions to the air pathway, air dispersion modeling of the PCBs to various receptors, and an assessment of health or injury to the receptors. Conservative assumptions were generally used to show worst-case scenarios for PCB exposure.

The results of this risk evaluation indicate that the Liquid Waste Processing Facilities can receive up to 6,000 μg/L PCBs in aqueous waste streams without posing an unreasonable risk of injury to human health or the environment. The Liquid Waste Processing Facilities can effectively treat 6,000 μg/L PCBs to a concentration of 0.5 μg/L, the point that discharge of the treated effluent is no longer subject to Toxic Substances Control Act requirements.

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FIGURES

TABLES

Acronym List

Note: This list contains acronyms used in both the Application and in Appendix 1.

BW	Body Weight
C	Concentration
CHG	CH2M Hill Hanford Group, Inc.
DF	Decontamination Factor
DOE	U.S. Department of Energy
DST	Double-Shell Tank
ED	Exposure Duration
Ecology	Washington State Department of Ecology
EPA	U.S. Environmental Protection Agency
ERDF	Environmental Restoration Disposal Facility
ERPC	Ecological Receptors of Potential Concern
ETF	Effluent Treatment Facility
FH	Fluor Hanford, Inc.
GAC	Granulated Active Carbon
HEPA	High-Efficiency Particulate Air
HMD	Hanford Map Distance
HQ	Hazard Quotient
IR	Intake Rate
ISC	Industrial Source Complex
ISCLT3	Industrial Source Complex Long Term 3
ISCST3	Industrial Source Complex Short Term 3
LADD	Lifetime Average Daily Dose
LERF	Liquid Effluent Retention Facility
LIGO	Laser Interferometer Gravitational-wave Observatory
LT	Lifetime
LWPF	Liquid Waste Processing Facilities
MDL	Method Detection Limit
MEI	Maximum Exposed Individual
NOC	Notice of Construction
ORP	Office of River Protection
OSHA	Occupational Safety and Health Administration
OX	Oxidation
PCB	Polychlorinated Biphenyl
RBDA	Risk-Based Disposal Approval
RCRA	Resource Conservation and Recovery Act
RfD	Reference Dose
RL	U.S. Department of Energy, Richland Operations Office
RO	Reverse Osmosis

SALDS	State Approved Liquid Disposal Site
SF	Slope Factor (or Cancer Slope Factor)
SST	Single-Shell Tank
SWRT	Secondary Waste Receiving Tanks
TDS	Total Dissolved Solids
TFD	Thin-Film Dryer
TRV	Toxicity Reference Value
TSCA	Toxic Substances Control Act
TSD	Treatment, Storage, or Disposal
UV	Ultraviolet
WAC	Washington Administrative Code
WDOH	Washington State Department of Health
WTP	Waste Treatment Plant

1.0 INTRODUCTION

The U.S. Environmental Protection Agency (EPA) amended the Federal regulations pursuant to the Toxic Substances Control Act (TSCA) on July 1, 1998. The revised regulations introduced several new concepts and requirements for management of polychlorinated biphenyl (PCB) waste, some of which are applicable to operations at the U.S. Department of Energy's (DOE) Liquid Waste Processing Facilities (LWPF) at the Hanford Site. The LWPF receive and treat numerous aqueous waste streams from various generators on the Hanford Site and some of these streams are currently designated, or have the potential to be designated, as "PCB Remediation Waste", under the definition specified at 40 CFR 761.61.

Any facility that receives liquid PCB remediation waste at concentrations greater than 0.5 micrograms per liter (µg/L) and uses a chemical treatment process to reduce the concentration to less than 0.5 µg/L must receive EPA approval for such treatment. The TSCA regulations offer three alternatives for disposal of PCB remediation waste. The DOE has agreed to use the risk-based disposal approval option (§761.61[c]), and this option requires EPA approval prior to treatment of PCB remediation waste. If a liquid PCB remediation waste contains less than 0.5 µg/L total PCBs, either in its "as found" state or after treatment, the waste is no longer subject to regulation under the TSCA and can be managed and disposed in accordance with other applicable regulations and requirements.

The LWPF does not yet have EPA approval as a PCB treatment facility, so the concentration of PCBs that the LWPF can receive from Hanford Site generators is currently restricted to less than 0.5 µg/L total PCB. This issue is important, as liquid PCB remediation waste streams are generated by a number of Hanford facilities and projects that depend on the LWPF for treatment of their waste streams. The LWPF has not yet received aqueous waste with total PCB concentrations greater than 0.5 µg/L; however, future streams might contain greater than 0.5 µg/L total PCB. If a waste stream were found to contain greater than 0.5 µg/L total PCB, treatment of that stream at the LWPF would be prohibited until the EPA approved the LWPF as a PCB treatment facility. This scenario would create compliance vulnerabilities, as well as cost impacts and schedule delays in carrying out the Hanford Site mission of waste management and environmental restoration.

The DOE Office of River Protection (ORP) is responsible for management of the Hanford Site tank farms, which generate one of the more significant waste streams treated by the LWPF. Tank waste evaporation campaigns are typically conducted on a semi-annual to annual basis, in which Double-Shell Tank (DST) waste supernatant is processed through the 242-A Evaporator (a LWPF unit), to reduce tank waste volumes. PCBs have been detected in the solid matrix of the waste in two tanks, at relatively low concentrations. This analytical data from tank waste is discussed further in Section 3.1.1.

The presence of PCB remediation waste in these tanks has an impact on the design, operation, and regulatory requirements of downstream facilities, such as the LWPF and the future Waste Treatment Plant (WTP) that will be used to vitrify tank waste into a glass form for disposal. The EPA, the DOE, and the Washington State Department of Ecology (Ecology) signed a *"Framework Agreement for Management of Polychlorinated Biphenyls (PCBs) in Hanford Tank Waste"* (Boston, et. al., 2000) on August 31, 2000, in which the parties agreed they would pursue a rational path for management of the tank waste based on a risk-based disposal approval (RBDA) option under §761.61(c). The Framework Agreement also requires that facilities upstream and downstream from the DSTs (i.e., those facilities that will manage a portion of the tank waste that may contain PCB remediation waste at some point in the process) be integrated into the risk-based approach. Therefore, this RBDA application for treatment of PCBs at the LWPF is appropriate from two standpoints. First, the RBDA is viewed as the single best method of documenting the capability of the LWPF to treat significant concentrations of PCBs in aqueous wastes. Second, the LWPF are downstream facilities to the tank farms and to the future WTP, so use of the RBDA is consistent with the Framework Agreement.

1.1 OBJECTIVE

The objective of this document is to obtain the necessary EPA approval for the LWPF to operate as a PCB treatment facility, with authorization to receive waste streams containing significantly higher total PCB concentrations than 0.5 μg/L. The DOE is requesting EPA approval to operate the LWPF as a PCB treatment facility under the option of RBDA, as specified at §761.61(c). The proposed maximum PCB concentrations to be received and treated at the LWPF, along with the proposed operating conditions, are included in Section 5.0.

A significant increase in the concentration of PCBs that the LWPF will be able to receive and treat will result in assurance that treatment of aqueous waste from current generators will not be interrupted. The authorization to receive aqueous waste with higher concentrations of PCBs will also provide important guidance to the WTP staff during the design phase, as they consider pre-treatment options for various chemicals in their effluent streams that may be necessary in order to meet the LWPF waste acceptance criteria (FH 2001b).

This RBDA includes an evaluation of risks associated with PCBs released to the environment from the LWPF via the air pathway (see Section 3.0). The aqueous waste streams (i.e., liquid wastes) treated by the LWPF are contained in a closed system with no route of exposure to the environment during normal operating conditions, with the exception of discharge of the treated effluent. Risks associated with the aqueous waste streams are addressed by a discussion and documentation regarding the efficacy of the LWPF liquid waste treatment system and the assurance that treated effluent discharge currently meets and will continue to meet the appropriate risk-based concentrations for PCBs. Liquid waste treatment is addressed further in Section 4.1.

This RBDA application addresses only the treatment or disposal of PCB remediation waste; it does not address the PCB "storage" requirements specified at §761.50. The DOE does not anticipate management of liquids or solids at the LWPF that exceed PCB concentrations of 50 ppm, so the PCB storage requirements are not applicable to the LWPF. The only waste streams that could have the potential to exceed the threshold for PCB storage requirements are the solid waste streams, as discussed in Section 4.2. If a solid waste should be found to exceed a total PCB concentration of 50 ppm, the waste will be stored and managed in a manner that is fully compliant with §761.50.

1.2 OVERVIEW OF LIQUID WASTE PROCESSING FACILITIES

The LWPF, for purposes of this RBDA, consist of a liquid waste management and treatment system comprised of the following three facilities and all interconnecting piping:

a. 242-A Evaporator (Evaporator),
b. Liquid Effluent Retention Facility (LERF), and
c. Effluent Treatment Facility (ETF).

Figure 1-1 shows the various facilities and processes that generate aqueous waste to be treated at the LWPF. The Evaporator receives aqueous waste from the tank farms, which are under the jurisdiction of the Hanford Site River Protection Project. The evaporation process generates a process condensate that is sent from the Evaporator to the LERF and then to the ETF for final treatment. Aqueous streams from other sources may go to either the LERF and then to the ETF for treatment or, in some cases, they may bypass the LERF and go directly to the ETF for final treatment.

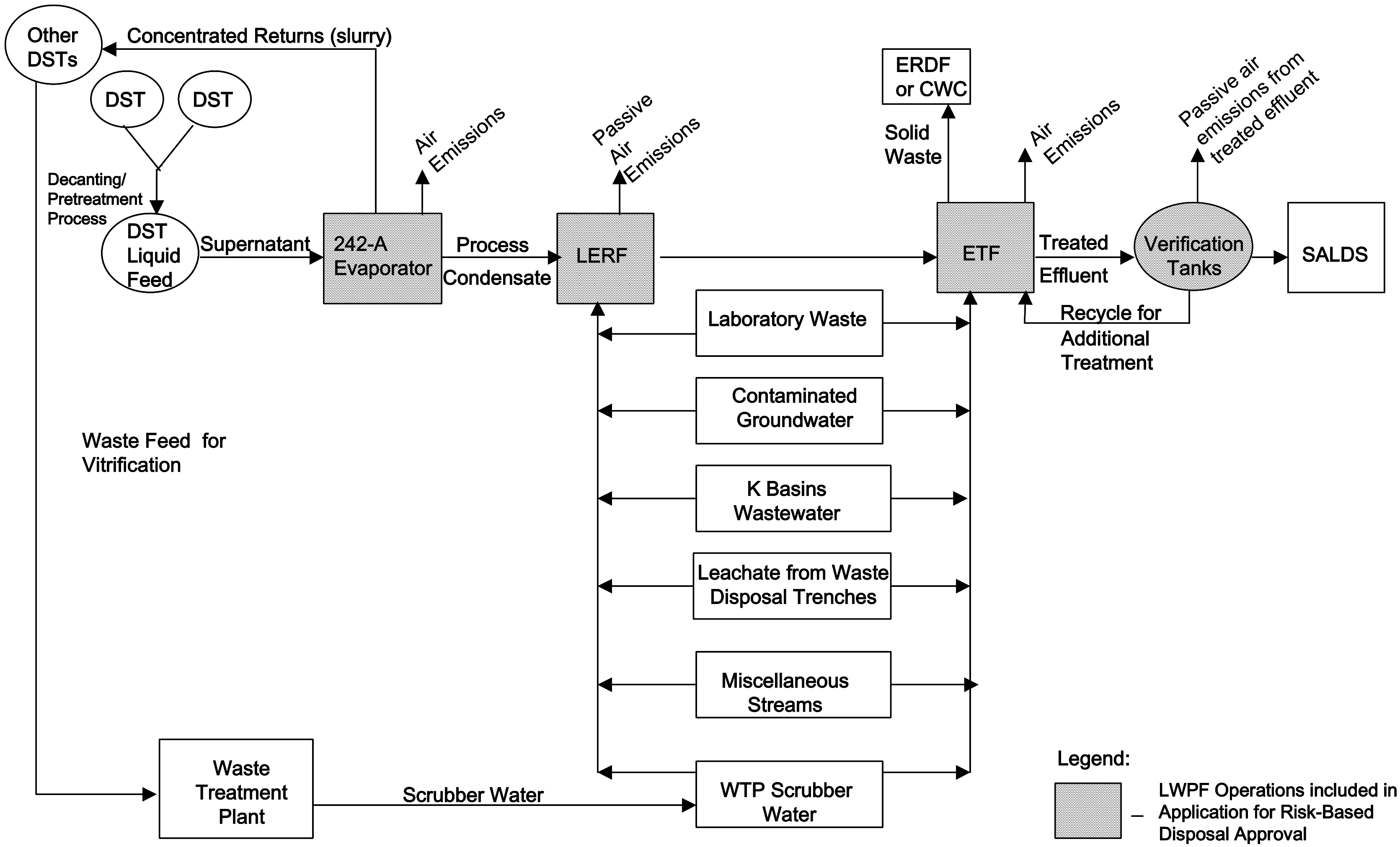

Figure 1-1 Process Flow Diagram of LWPF Facilities

1.3 POLYCHLORINATED BIPHENYL SOURCES

Liquid waste that may be classified as PCB remediation waste is generated at several locations across the site and will continue to be generated and sent to the LWPF for many years. The primary projects that currently generate such waste are:

- River Protection Project – Waste from tank farms is routinely processed in the Evaporator and waste from the WTP (e.g., scrubber water) will require treatment at the ETF in the future
- Spent Nuclear Fuel Project – Water covering the spent fuel in the K Basins
- Environmental Restoration Project – Contaminated groundwater obtained through pump and treat programs or liquid waste associated with decontamination and decommissioning activities
- Waste Management Project – Leachate collected from waste disposal trenches
- Facilities Transition Project – Liquid waste obtained through routine activities or the deactivation processes
- Miscellaneous streams not otherwise specified

To date, the liquid wastes that have entered the LWPF have not been found to contain PCBs in excess of the detection limits. A further discussion of detection limits is contained in Section 3.1.

1.4 WASTE ACCEPTANCE CRITERIA

The maximum PCB concentration of liquid PCB remediation waste allowed to enter the LWPF is restricted to less than 0.5 μg/L. This limitation became effective when the EPA revised the TSCA regulations on July 1, 1998. Any higher concentration requires the facility to be approved as a PCB treatment unit by EPA.

The LWPF requirements for wastewater acceptance are specified in the *"Liquid Waste Processing Facilities Waste Acceptance Criteria"*, HNF-3172, Revision 1 (FH 2001b). This document contains the acceptance criteria and addresses responsibilities of generators sending wastewater to the LWPF for treatment.

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2.0 GENERAL PROCESS DESCRIPTION

The LWPF, comprised of the Evaporator, the LERF, and the ETF, function as an aqueous waste treatment system. Figure 1-1 illustrates that some aqueous waste streams flow through all three units, while in other cases, a waste stream may only enter the LERF and the ETF, or in some cases only the ETF. For the purposes of this RBDA application, all three facilities are considered part of the LWPF. Therefore, the EPA's approval of this RBDA application will allow the LWPF to accept PCBs in incoming aqueous waste streams at concentrations greater than 0.5 µg/L and in accordance with the operating conditions specified in Section 5.0.

2.1 242-A EVAPORATOR

Fluor Hanford, Inc. (FH) conducts evaporation "campaigns", in which waste from specific tanks is evaporated to reduce tank waste volume. The Evaporator receives waste supernatant directly from the tank farms for the purpose of boiling off excess water, which increases the available waste storage capacity in the waste tanks. Tank waste is decanted prior to receipt at the Evaporator to minimize the solids in the waste stream. Typically, each campaign lasts about a month and approximately one to two campaigns are conducted each year. Each campaign generates approximately 750,000 gallons of process condensate, which is designated as dangerous/radioactive mixed waste. The evaporation process creates four separate process waste streams:

a. concentrated slurry that returns to tank farms,
b. process condensate that is piped to the LERF for storage prior to treatment at the ETF,
c. air emissions resulting from the evaporation process, and
d. non-contact cooling water and steam condensate.

The non-contact cooling water and steam condensate are non-hazardous, non-radioactive effluents that are discharged to the 200 Area Treated Effluent Disposal Facility under the State Waste Discharge Permit ST 4502 (Ecology 2000b). These streams do not have the potential for PCB contamination, as they do not come into contact with the tank waste. Accordingly, these streams are not addressed further in this RBDA application.

Figure 2-1 shows the process flow through the Evaporator.

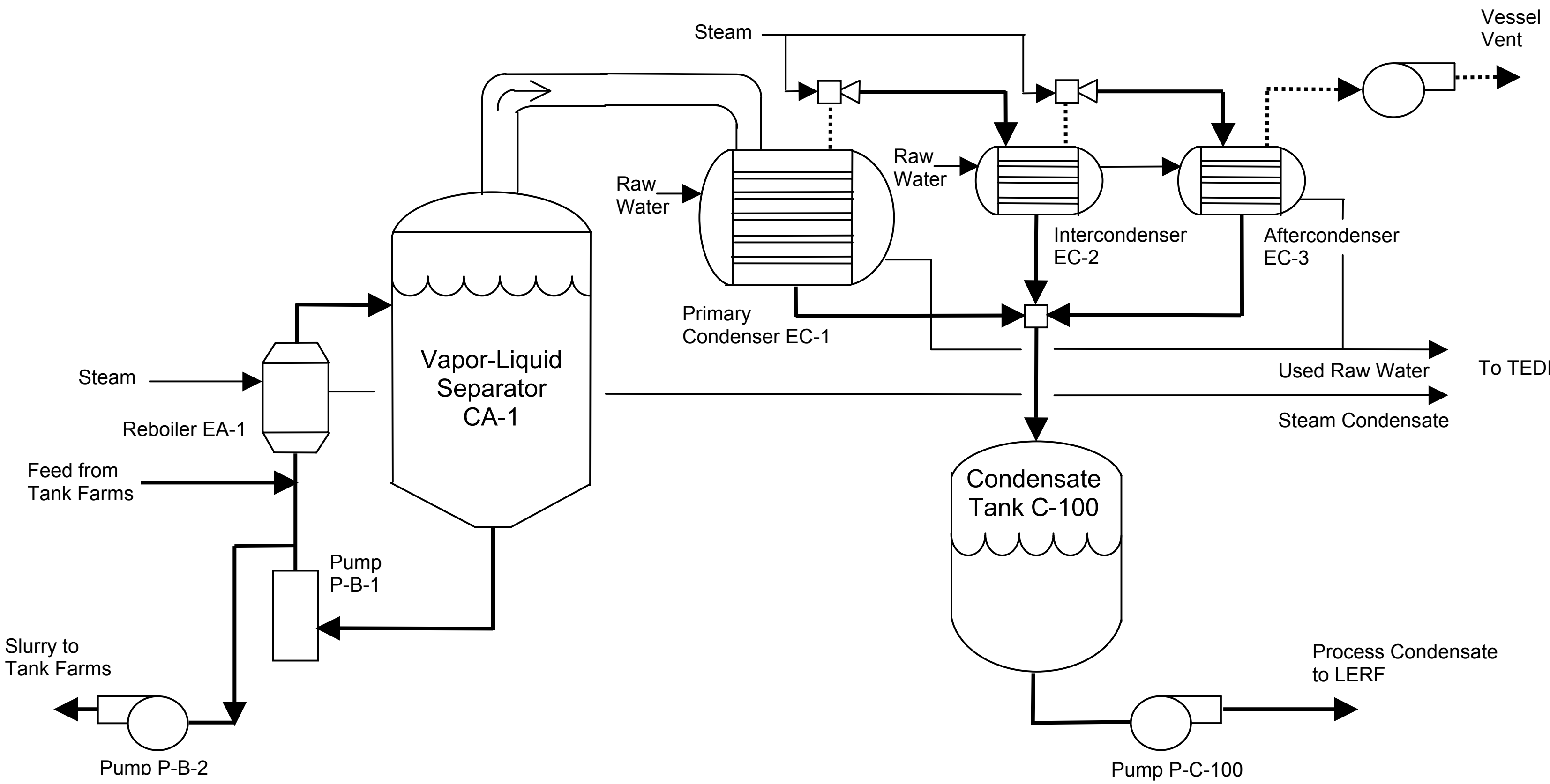

Figure 2-1 Process Flow Through the Evaporator

The most recent evaporation campaign (Campaign 2001-01) was conducted in the Spring of 2001 and the next campaign is planned for late Spring 2002. The EPA required that a risk evaluation specific to Campaign 2001-01 and to the wastes from Tank 104-AW be conducted and approved prior to the campaign. The DOE submitted the risk evaluation to EPA for approval on February 7, 2001 (FH 2001a) and the EPA approved the risk evaluation on February 15, 2001 (EPA 2001). This risk evaluation indicated that approximately 94 percent of the total PCBs entering the Evaporator from the DSTs would remain in the process condensate and be transferred to the ETF for treatment. The remaining PCBs would be returned to the DSTs as concentrated returns (approximately one percent) or emitted through the Evaporator stack to the air (approximately five percent). Tank waste characterization data have not indicated measurable amounts of PCBs in the Tank 104-AW supernatant feed to the Evaporator, with method detection limits (MDL) in the range of 20 μg/L to 40 μg/L. Therefore, at that time, the tank waste was presumed to contain up to 40 μg/L total PCB and the risk evaluation model was run at that concentration. The results of the risk evaluation indicated the impact to Hanford Site workers was approximately 12 percent of the Occupational Safety and Health Administration's permissible exposure limit for PCB and the exposure to the public (offsite) represented less than one in a trillion (10^{-12}) risk of excess cancer incidence.

The DOE submitted a 45-day follow-up report after Campaign 2001-01 (RL 2001). The follow-up report generally validated the range of risks that were stated in the risk evaluation and, in some cases, provided new information about the assumptions that had been made in the risk evaluation. Such changes included better information regarding the operating temperature for the EC-1 condenser. This unit was assumed to operate at 33°C in the risk evaluation (FH 2001a), but was later found to operate at a range of 34°C to 44°C, with an average of 40°C. This changed the percentage of PCBs in the DST feedstream to the Evaporator that would enter the air via the Evaporator stack from five percent to seven percent. This risk evaluation is based on the best operating information available, including data obtained during the last evaporation campaign, so the mass of PCBs discharged to the air pathway from the Evaporator is assumed to be seven percent of the available PCBs in the DST feedstream.

FH operates the Evaporator in accordance with conditions specified in the Hanford Site-wide Resource Conservation and Recovery Act (RCRA) Permit (Ecology 2000a). This permit contains a section specific to the Evaporator, with authorized waste processing codes for storage of hazardous waste in tanks and treatment of hazardous waste in "other units". The RCRA Permit does not address the storage or treatment of PCBs. The RCRA requirements for air emissions (40 CFR Part 264, Subpart AA) from the Evaporator are addressed in Section 4.2 of the RCRA Permit, which limits the total organic air emissions for all Hanford Facilities to 1.4 kg/hour and 2.8 megagrams/year. If these limits are exceeded, control devices must be installed to reduce organic emissions by 95 percent. Emissions from the Evaporator are well below these thresholds, so control devices are not required (see Appendix 1, Section A.2.1.1).

The Evaporator closure plan in the RCRA Permit requires that the Evaporator be "clean closed", in accordance with WAC 173-303-610(2). The TSCA regulations (§761.65[e][3]) state that a separate TSCA Closure Plan is not required in cases where a facility is currently covered by a RCRA permit, upon demonstration to the EPA Regional Administrator that the RCRA Closure Plan is substantially equivalent to the requirements of a TSCA Closure Plan. The TSCA decontamination requirements (§761.79) for non-liquid PCB remediation waste would normally apply as a practical means for demonstrating "clean closure" of Evaporator system components at the time of facility closure (§761.61[b][2][ii]). However, in this case, the RCRA clean closure requirements for the Evaporator will be sufficient to address the PCBs that may have adhered to Evaporator system components.

A high-efficiency particulate air (HEPA) filter removes particulates, including radionuclides, from the air stream, but the stack does not have organic removal capability, such as granulated activated carbon (GAC). The Evaporator is included in the Air Operating Permit, issued per WAC 17-401 and organic emissions are regulated under 40 CFR 264 Subpart AA. Because the Evaporator has a process vent subject to RCRA, it is exempt from toxic air pollutant requirements, per WAC 173-460-030(e).

2.2 LIQUID EFFLUENT RETENTION FACILITY

The LERF is a double-lined surface impoundment system consisting of three separate basins for storage of liquid waste to be treated at the ETF. These basins are available to receive a variety of aqueous waste streams from Hanford Site operations and cleanup projects. Figure 2-2 is a schematic of process flow through the LERF.

Each LERF basin has the capacity to store 7.8 million gallons of wastewater and has a floating cover to minimize unwanted material from entering the basin and to minimize evaporation of the aqueous waste. The floating cover and the low vapor pressure of PCBs combine to minimize the potential for measurable amounts of PCBs to enter the air pathway from the LERF. Therefore, it is reasonable to assume that the concentrations of PCBs in the aqueous waste during interim storage in the LERF remain constant. A passive breather vent is provided for each basin to accommodate expansion and contraction of the floating cover due to changes in waste volume. The basins are designed to have no air emissions, since the LERF is a bladder system. Each breather vent is equipped with a drum containing 200 pounds of GAC. These GAC canisters are expected to be effective for removal of organic vapor, including PCBs, for the life of the LERF basins without requiring replacement.

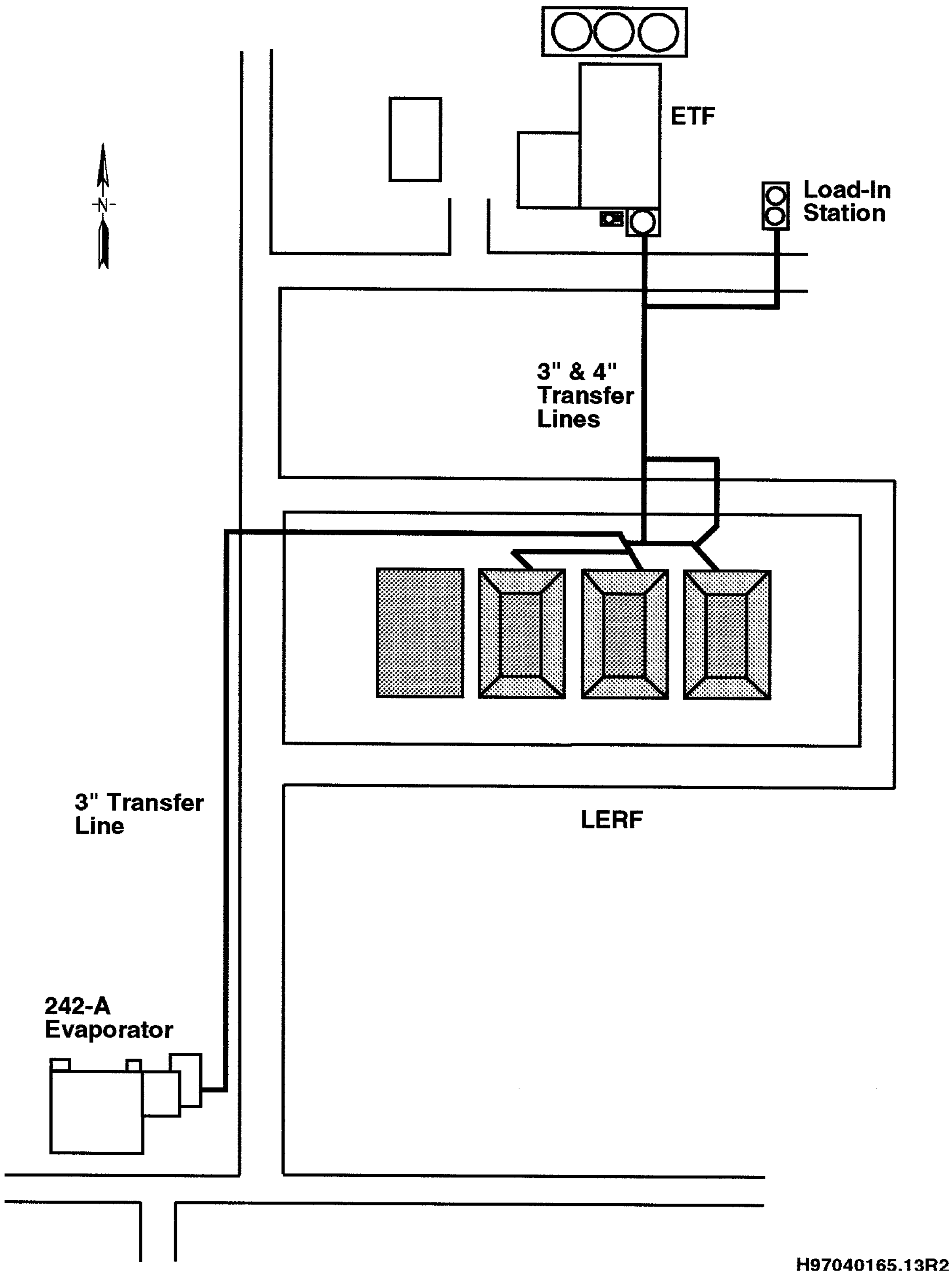

Figure 2-2 Process Flow Through the LERF

PCBs at very low concentrations are compatible with the materials of construction in the LERF. The primary and secondary liners are made of high-density polyethylene and the floating cover is made of low-density polyethylene. Other system components, such as pipes and pumps are also chemically compatible with low concentrations of PCBs.

The River Protection Project typically requires one to two DST evaporation campaigns each year and each campaign generates approximately 750,000 gallons of process condensate that is routed to the LERF. The LERF also receives aqueous waste from other sources, including contaminated groundwater collected for treatment, water from the K Basins, laboratory waste, and leachate from disposal trenches. In the future, aqueous waste from the WTP may be routed to the LERF prior to treatment at the ETF. Aqueous waste containing PCB remediation waste may be routed to any of the LERF basins.

FH is authorized to store and treat RCRA mixed waste in the LERF under conditions specified in the Hanford Site-wide RCRA Permit (Ecology 2000a). The RCRA Permit contains a section specific to the LERF and the process codes are identified in Chapter 1 of the permit. The RCRA Permit does not address management of PCBs. The LERF provides surge capacity and blending capability for aqueous waste going to the ETF and is not designed or intended to reduce or alter the concentration of PCBs in the aqueous waste.

The LERF Closure Plan in the RCRA Permit requires that the LERF basins be "clean closed", in accordance with WAC 173-303-610(2). The TSCA regulations (§761.65[e][3]) state that a separate TSCA Closure Plan is not required in cases where a facility is currently covered by a RCRA permit, upon demonstrating to the EPA Regional Administrator that the RCRA Closure Plan is substantially equivalent to the requirements of a TSCA Closure Plan. The TSCA decontamination requirements (§761.79) for non-liquid PCB remediation waste would normally apply as a practical means for demonstrating "clean closure" of LERF system components at the time of facility closure (§761.61[b][2][ii]). However, in this case, the RCRA clean closure requirements for the LERF will be sufficient to address the trace amounts of PCBs that may be adhered to LERF system components.

The LERF is subject to the conditions of approved toxic air pollutant NOC under WAC 173-400 and WAC 173-460 and for radiological air emissions NOC under WAC 246-247. Ecology issues the approvals for the toxic air pollutant NOC and the Washington State Department of Health (WDOH) issues the approval for the radiological air emissions NOC. The current toxic air pollutant NOC, modified in January 2001, includes PCB as a constituent of concern, but does not require monitoring for PCBs.

Table 1.6 in the Hanford Site Air Operating Permit (Ecology 2001), titled "Emission Limits and Periodic Monitoring Requirements for Emission Units with NOC Approval

Conditions" requires the following of the DOE: "Any addition of waste streams that do not meet the new source review exemption in WAC 173-460-040(2)(c) or that have previously unidentified constituents to the facility requires prior review and approval by the Department of [Ecology]". The DOE provided a list of organic toxic air pollutants in the toxic air pollutant NOC for the LERF and the ETF. The DOE included PCBs on this list, which was approved by Ecology on January 26, 2001. Therefore, the acceptance of PCB remediation waste at these facilities will not trigger review and approval by Ecology under the conditions of the Air Operating Permit.

2.3 EFFLUENT TREATMENT FACILITY

The ETF generates three types of waste streams, as follows.

1) *Treated effluent* – treated effluent from the ETF is analyzed for hazardous constituents and other contaminants to ensure it meets applicable discharge requirements for disposal to the soil column at the State Approved Liquid Disposal Site (SALDS). This waste is "delisted" as a hazardous or dangerous waste after treatment and verification analysis, prior to discharge to the soil column. Liquid waste management is discussed in Section 4.1.

2) *Solid waste* – the treatment process also generates a solid waste stream in the form of a powder, which is drummed and shipped to other approved Hanford Site facilities for further processing, as necessary, and disposal. Solid waste management is discussed in Section 4.2.

3) *Air emissions* – the aqueous waste treatment process generates air emissions that are filtered to remove radioactive and organic contaminants prior to release to the air.

The ETF has extensive aqueous waste treatment capacity for a variety of contaminants. The process flow for the main treatment train and the secondary treatment train is shown in Figure 2-3. PCBs are very effectively treated by the standard treatment configuration at the ETF, also referred to as Configuration 1. In Configuration 1, which is the primary configuration that has been used since the ETF began operations in 1995, wastewater is first routed to the ultraviolet (UV) oxidation units, then to the degasification column, two stages of reverse osmosis (RO), and two stages of ion exchange polishing. The UV oxidation serves as the key step for PCB treatment and occurs before the waste stream reaches a potential point of air release through the degasification column. Configuration 1 effectively destroys or removes PCBs to less than 0.5 µg/L in the treated effluent; the concentration at which no further TSCA requirements are applicable to the aqueous waste (§761.30[u][3]).

Configuration 2 is being considered for future waste streams that may contain high concentrations of nitrates. Configuration 2 is very similar to Configuration 1 if volatile organics are present.

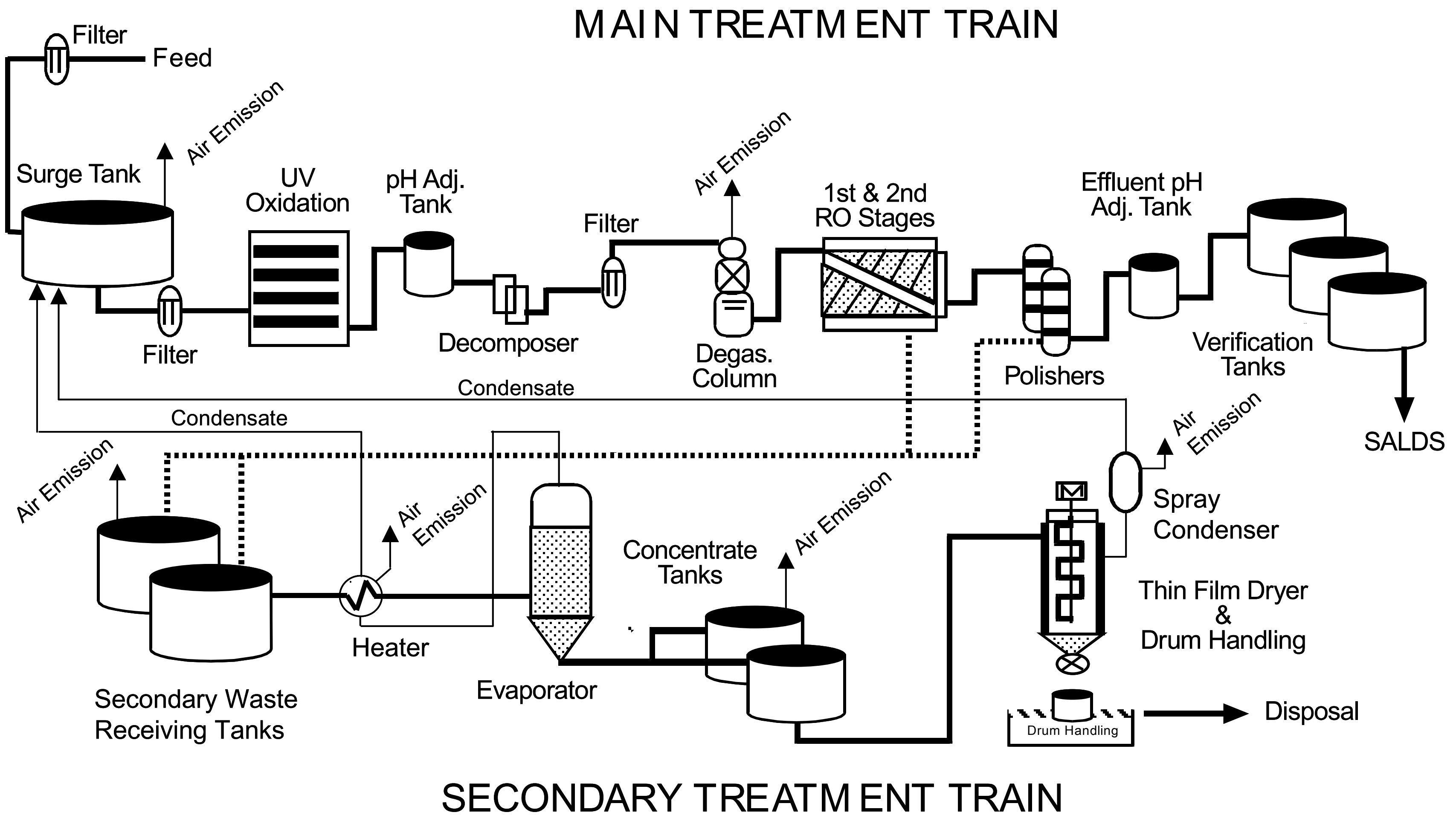

Figure 2-3 Process Configuration at the ETF

Configuration 3 is being used to treat waste streams that may contain high total dissolved solids (TDS). In this configuration, the waste stream would be initially received into the secondary treatment train, rather than the main treatment train (see Figure 2-3). The waste stream would be routed from the secondary receiving tanks to the evaporator and onto the concentrate tanks and then to the dryer. Overheads from both the evaporator and the dryer would be routed to the main treatment train surge tank and then onto the UV oxidation step for PCB destruction. In Configuration 3, there is a potential to emit greater quantities of PCBs to the air pathway from the evaporator and dryer, as these steps precede the UV oxidation process. Flexibility to use any of the treatment configurations at the ETF must be maintained, so the risk evaluation summarized in Section 3.1.1 includes modeling of emissions in both Configuration 1 and Configuration 3.

PCBs, when subjected to UV oxidation, undergo a first order kinetic reaction in which the PCB molecules are decayed or destroyed. This destruction follows a logarithmic decay rate, irrespective of the initial PCB concentration. This means that PCB decay follows essentially the same decay curve for any initial PCB concentration, based on an oxidation rate constant of 4.5 $(\text{min})^{-1}$. This curve, adapted from the August 1993 Delisting Petition (DOE 1993b), is shown on Figure 2-4. The standard UV oxidation residence time at the ETF is 2.08 minutes, however this time can be adjusted by reducing the flow rate if additional residence time is required. The decay curve for PCB is based on the operation of six UV lamps per each parallel UV oxidation section. As an example of the destruction efficiency, an initial concentration of 50 μg/L PCB will be reduced to approximately 0.01 μg/L after a residence time of two minutes in the UV oxidation unit. The same general curve for decay or destruction of PCBs is followed for any initial concentration of PCB in wastewater, assuming a two-minute residence time in the UV oxidation unit, with six UV lamps in operation per parallel UV oxidation section.

Following UV oxidation in Configuration 1, the wastewater is routed through a degasification column, which uses air to strip most of the trace amount of remaining PCBs into the gas phase. The degasification column gas phase discharges to the ETF vessel off-gas system. The wastewater then passes through two stages of RO and two stages of ion exchange polishing. The RO process is very effective at removing large molecules (i.e., high molecular weight molecules), such as PCBs. PCBs removed during the RO process, along with other RO treatment residues, are routed to the secondary treatment train, where the waste undergoes a concentration process to become the thin-film drying powder. The high temperatures in the evaporator and the thin-film dryer volatilize any residual PCBs that enter the secondary treatment train. The volatile components condense and recycle back to the surge tank for routing through the main treatment train. No PCBs are expected to be present in the powder waste. This secondary waste is managed as a mixed waste and is containerized and shipped to other Hanford Site facilities for treatment, as necessary, and disposal. Management of the thin-film drying powder is not part of this RBDA application, as stated in Section 4.2.

The treated effluent from the ETF is discharged to the soil column at the SALDS, located north of the 200 West Area of the Hanford Site. All discharges must meet the concentration-based limit specified in the Washington State Wastewater Discharge Permit (Ecology 2000b). Presently, this permit does not include PCB as a monitoring parameter. Under this permit, the DOE is required to maintain a list of approved influent constituents and their approved concentrations. If the Permittee proposes to accept a new constituent or a constituent at a concentration greater than 20 percent above the approved influent concentration, then Ecology will determine whether a permit modification, with public review and comment, is appropriate. The PCBs are included on the current approved influent constituent list for the LERF, with an approved maximum influent concentration limit of 150 μg/L.

FH is authorized to receive, store, and treat RCRA mixed waste under conditions specified in the Hanford Site-wide RCRA Permit (Ecology 2001a). The RCRA Permit contains a section specific to the LERF and the ETF and the process codes on the RCRA Part A permit application include storage and treatment in tanks and containers at the ETF. The RCRA Permit does not address storage or treatment of PCBs. The RCRA requirements for air emissions (40 CFR Part 264, Subpart AA) from the ETF are addressed in Section 4.6 of the RCRA Permit, which limits the total organic air emissions for all Hanford Facilities to 1.4 kg/hour and 2.8 megagrams/year. If these limits are exceeded, control devices must be installed to reduce organic emissions by 95 percent. Emissions from the ETF are well below these thresholds, so control devices are not required (see Appendix 1, Section A.2.1.2).

The ETF Closure Plan in the RCRA Permit requires that the entire ETF be "clean closed", in accordance with WAC 173-303-610(2). The TSCA regulations (§761.65[e][3]) state that a separate TSCA Closure Plan does not have to be submitted in cases where a facility is currently covered by a RCRA permit, upon a showing to the EPA Regional Administrator that the RCRA Closure Plan is substantially equivalent to the requirements of a TSCA Closure Plan. The TSCA decontamination requirements (§761.79) for non-liquid PCB remediation waste would normally apply as a practical means for demonstrating "clean closure" of ETF system components at the time of facility closure (§761.61[b][2][ii]). However, in this case, the RCRA clean closure requirements for the ETF will be sufficient to address the PCBs that may be adhered to ETF system components.

The ETF discharges air emissions from the treatment operation through a common header and stack, after GAC filtration to remove organics and HEPA filtration to remove radionuclides. The ETF is included in the Air Operating Permit, issued per WAC 17-401 and organic emissions are regulated under 40 CFR 264 Subpart AA. Because the ETF has a process vent subject to RCRA, it is exempt from toxic air pollutant requirements, per WAC 173-460-030(e).

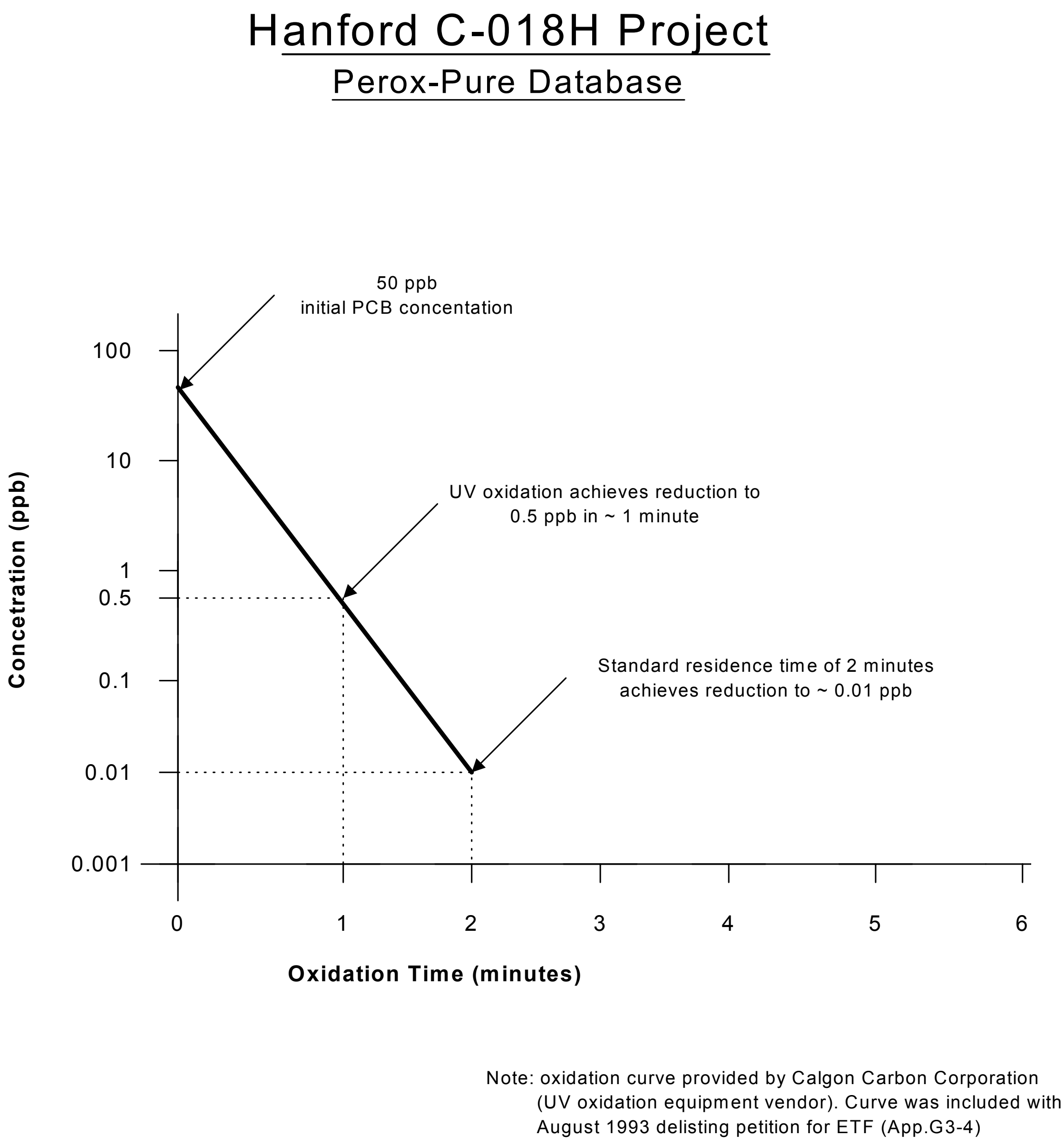

Figure 2-4 Oxidation Curve for PCB, using ETF Ultraviolet Oxidation Unit

Analyses of incoming aqueous waste streams at the ETF have not yet shown concentrations of PCBs above the MDL. PCBs that may be present at less than MDLs should have no measurable effect on the air emissions and are not expected to result in any significant effect on compliance with 40 CFR 264 Subpart AA for volatile organic compound emissions.

Table 1.6 in the Hanford Site Air Operating Permit (Ecology 2001), titled "Emission Limits and Periodic Monitoring Requirements for Emission Units with NOC Approval Conditions" requires the following of the DOE: "Any addition of waste streams that do not meet the new source review exemption in WAC 173-460-040(2)(c) or that have previously unidentified constituents to the facility requires prior review and approval by the Department of [Ecology]". The DOE provided a list of organic toxic air pollutants in the toxic air pollutant NOC for the LERF and the ETF load-in station. The DOE included PCBs on this list, which was approved by Ecology on January 26, 2001. Therefore, the acceptance of PCB remediation waste at these facilities will not trigger review and approval by Ecology under the conditions of the Air Operating Permit.

3.0 RISK EVALUATION

The basis for approval of this RBDA application is that aqueous waste containing PCB remediation waste at specified concentrations can be received and treated by the LWPF, in accordance with specified operating requirements, practices and safeguards, without causing an unreasonable risk of injury to human health or the environment (§761.61[c][2]). The risk evaluation provides EPA with the necessary information to evaluate and approve this application. The actual risk evaluation calculations are contained in Appendix 1 to this RBDA application. The remainder of this section includes a summary description of the approach and methodology and a summary of the risk evaluation results.

3.1 APPROACH AND METHODOLOGY

This section addresses the risks associated with treatment of PCBs in the LWPF for the air pathways from the Evaporator and the ETF. The risk is evaluated for the Hanford Site the workers, the public, and ecological receptors. The *"PCB Risk Assessment Review Guidance Document"* (Interim Draft) prepared by Versar, Inc. on January 12, 2000 for EPA Headquarters (EPA 2000), was used as a guideline in preparing the risk evaluation.

The Hanford Site tank farm operations contractor, CH2M Hill Hanford Group (CHG), issued a risk assessment of PCBs in the DST system in August 2001 (CHG 2001a). The DST waste comprises one of the key feed streams to the LWPF and serves as the only feed stream to the Evaporator (see Figure 1-1). Therefore, it is appropriate that the approach used for the LWPF risk evaluation parallel the DST risk assessment, to the extent practicable.

The ORP and CHG developed a model to determine the mass balance of PCBs in the tank waste system and this information is available in the *"Model of PCB Distribution in the Liquid Waste Handling System"* (CHG 2001b). This document is presently in the CHG review process and has not yet been issued, as explained in the Section 7.0 reference. This model provides an estimate of the distribution of PCBs, by mass and concentration, to downstream facilities from 2001 through 2019. The Evaporator is one of the downstream facilities for which the mass and concentration of PCBs from DST waste are estimated.

Sections 3.1.1 and 3.1.2 include a more detailed description of the methods used to calculate potential PCB emissions to the environment via the air pathway and to model those emissions to estimate risk to the workers, the public, and ecological receptors. The solid waste and liquid waste pathways are not part of this risk evaluation and are discussed further in Sections 4.1 and 4.2.

The LWPF has not yet received PCBs in the incoming waste streams at concentrations above the MDL. This raises the issue of how to address the total PCB concentration in a waste stream, as PCB concentrations are reported by specific Aroclor concentration. The *"Toxic Substances Control Act Polychlorinated Biphenyl, Hanford Site Users Guide"* (DOE 2002), Section 3.2.3, provides the guidance for how to determine total PCB concentrations in waste samples that contain less than the MDL for individual Aroclors. That process is as follows:

a. If no Aroclors are detected and there is sufficient information or process knowledge to expect specific Aroclors in the sample, the total PCB concentration is the MDL for the single most common Aroclor expected.

b. If no Aroclors are detected and there is not sufficient information or process knowledge to expect specific Aroclors in the sample, the total PCB concentration is the highest single Aroclor MDL reported.

c. If one or more Aroclors are detected, the total PCB concentration is calculated by summing the detected Aroclors, but does not include Aroclor values reported at or below the MDL.

3.1.1 Human Health

This risk evaluation includes a review of PCB emissions from the Evaporator and the ETF, with the air pathway as the route of exposure. The air pathway from each of these units is evaluated separately and the potential exposures and effects are then combined to reflect the overall impact of the potential release of PCBs to the environment from the LWPF. Release scenarios are varied to provide a range of risks associated with very low levels of PCBs in the liquid waste streams to relatively high levels of PCBs.

The *"Double-Shell Tank PCB Risk Assessment"*, (CHG 2001a), Section 5.0, addresses human health impacts from PCBs released to the air pathway from the DSTs in the Hanford Site 200 Areas. The assumptions and methodology for evaluation of risk to human health posed by releases of PCBs to the air pathway from the LWPF would be the same as for DSTs, with following exceptions:

a. The concentrations of PCBs released to the air pathway from the LWPF are different, in most cases, from the concentrations modeled for the DSTs;

b. The unit specific conditions (e.g., stack height, air discharge velocity, duration of operation, etc.) are based on the LWPF conditions, rather than DST conditions;

c. The point of exposure to the public for the LWPF risk evaluation is the Energy Northwest facility. The point of exposure for the DST risk assessment was Highway 240. The Hanford Site model has been revised since August 2001 to assume the public citizen who would be the maximum exposed individual (MEI) is located at the Energy Northwest facility.

d. The Industrial Source Complex (ISC)-3 dispersion model was used to model the airborne transport of PCBs from the LWPF. The DST risk assessment was based on the SCREEN3 model. Both models are approved by the EPA, but the ISC-3 model requires more precise inputs than the SCREEN3 model.

PCB EMISSION MODEL

The first step in the risk evaluation process is emission modeling from each of the Evaporator and the ETF, using three different concentrations of PCBs in the aqueous waste received by the LWPF. The emission model for ETF calculates potential PCB emissions in Configuration 1 and Configuration 3 (see Section 2.3 regarding a description of the different configurations). Separate emission calculations were made for Configuration 3, as the waste streams do not go through the UV oxidation step prior to secondary treatment train processes that generate air emissions. Configuration 3, therefore, is considered the bounding case for PCB air emissions from the ETF. Expected emissions of PCB to the air pathway from Configuration 2 are considered the same as for Configuration 1, since the waste stream goes through the UV oxidation step early in the process and before other treatment steps that generate air emissions. Therefore, a separate model was not run for Configuration 2.

Stack emissions from the Evaporator and ETF are modeled to determine the amount of PCBs that could be discharged to the air during normal operations. The Evaporator and ETF are modeled assuming the vapor exiting each unit is in equilibrium with the solution. Equilibrium can be determined for dilute aqueous solutions using Henry's Law:

$$y_A P = x_A H_A \quad \text{or} \quad y_A = x_A \left(\frac{H_A}{P} \right)$$

where:
x_A = Mole fraction of component A in the liquid phase
y_A = Mole fraction of component A in the gas phase exiting the unit
P = System pressure
H = Henry's Law constant for constituent at the temperature of the unit.

Henry's Law constants are temperature dependant, increasing with rising temperature. Henry's Law constants are obtained with temperature correction factors to model the wide range of temperatures in the units at LWPF. Given the liquid and gas phase flow rates, operating temperatures, and pressures, the partitioning of PCBs through the various units can be determined. Credit is not taken for removal of PCBs by the GAC filters that are in place at the ETF air emission points.

There are three units where alternate techniques are used to determine the PCB partitioning:

a. At the 242-A Evaporator, the condensate collection tank is modeled using a two-phase mass diffusion model because the tank is unagitated and the condensate injects below the surface level. Diffusion rates for PCBs are calculated based on information in "*PCBs in the Upper Hudson River, Volume 2: A Model of PCB Fate,Transport, and Bioaccumulation*" (GE 1999) Emissions from the tank's air purge dip tubes are determined using Henry's Law.

b. At ETF, the UV oxidation system destroys organics using UV light and hydrogen peroxide. The model assumes the concentration of PCBs in the waste is reduced by a factor of 11,600, based on data from the "*200 Area Effluent Treatment Facility Delisting Petition*" (DOE 1993b). This excellent destruction of PCBs ensures emissions from units downstream of the UV oxidation system are very small.

c. At ETF, the degasification column removes dissolved gases and volatile components from the waste stream using countercurrent airflow in a packed column. The degasification column is modeled based on calculations provided by its designers for removal of carbon dioxide. The model uses data for chlorobenzene to represent PCBs. Based on the model, the concentration of PCBs in the waste is reduced by a factor of 500 in the degasification column, with the PCBs being discharged into the vessel off-gas system. For waste containing PCBs, the degasification column must be downstream of the UV oxidation system to ensure the PCBs are destroyed before they can transfer to the gas phase.

Three different scenarios, based on varied PCB concentrations in the aqueous waste streams received by the LWPF, are modeled for the Evaporator, the ETF (Configuration 1) and the ETF (Configuration 3). The rationale for selecting the concentrations is as follows:

0.2 μg/L – Much of the existing data for PCB analysis of aqueous waste at the Hanford Site is based on an MDL of 0.2 μg/L. To date, the LWPF has not received waste with PCB concentrations that exceed the MDL. Modeling at this concentration provides information about the risk associated with treatment of "trace" levels of PCBs.

600 μg/L – The LWPF considers seven Aroclors as possible contaminants in the wastewater it receives from various Hanford Site generators. The Aroclor with the highest solubility in water is Aroclor 1221, at 590 μg/L, at 24 degrees C. Solubilities of other Aroclors range to a low value of 57 μg/L, at standard temperature, with an average value of approximately 300 μg/L. Modeling emissions from the treatment of aqueous waste at

600 μg/L total PCBs provides an upper bound of what is reasonably expected to be contained in aqueous waste received by the LWPF based on solubility limits in water.

6,000 μg/L – This concentration provides a highly conservative, bounding case, which is an order of magnitude above the solubility limit for the most soluble Aroclor. It is also relatively close to the maximum PCB concentration that the UV oxidation process, by itself, could receive and still treat to 0.5 μg/L PCB in a single-pass treatment process, based on a decontamination factor of 11,600.

Recent analytical results indicate that PCBs have now been detected at concentrations above the MDL in two of the tanks under the jurisdiction of the ORP. In each case, Aroclor 1254 was measured in "solid" sample matrix from a core composite. Also, in each case, the PCB concentrations in the "liquids" were less than the MDLs. This is important because only liquids are routed from DSTs to the Evaporator, following a decanting process to minimize solids prior to transfer to the Evaporator. Tank waste sample number S01T001115, dated November 2000 from Tank 241-SY-102 (a DST), contained 1499 μg/kg (ppb) PCB in the solids. Sample number S01T001581, dated February 2001 from Tank 241-C-107 (a Single-Shell Tank [SST]) contained 310.4 μg/kg (ppb) PCB in the solids. The MDLs for both solids and liquids in previous analyses were significantly higher than the MDLs and the reported values in the November 2000 and February 2001 samples. The CHG incorporated these data into the DRAFT DST model of PCB distribution (CHG 2001b). This model indicates that previous assumptions about PCB concentrations in DST waste, based on high MDLs, have resulted in an overstatement of the amount of PCBs in tank waste.

The comparison of the previous estimates and the current estimates regarding the mass and concentrations of PCBs in the SSTs and DSTs is shown in Table 3.1 below. The source of the information in Table 3.1 is the DST model of PCB distribution (CHG 2001).

The recent data and calculated estimates shown in Table 3.1 indicate that the predicted concentrations of PCBs in SSTs and DSTs, based on historically high MDLs, were significantly higher than the actual values. Therefore, it is assumed that 0.13 mg/L (130 μg/L) total PCBs is a reasonable estimate of PCBs in the DST feedstream to the Evaporator. This risk evaluation was not conducted with an assumed concentration of 130 μg/L, but that value is clearly bounded by the concentrations modeled (i.e., 0.2 μg/L, 600 μg/L, and 6,000 μg/L).

PCB Parameter	Previous Expectations	Revised Expectations
Estimated total mass of PCB in SSTs and DSTs	3,998 kg	129 kg (of which 84 kg remains in SSTs in 2019)
Estimated concentration of PCB in SST and DST *liquid* matrix	2.9 mg/L	0.13 mg/L
Estimated concentration of PCB in SST and DST *solid* matrix	50 mg/kg	1.5 mg/kg
Estimated mass of PCB exiting the Evaporator stack (19 evaporation campaigns from 2001 through 2019)	Not calculated	1.0 kg
Estimated mass of PCB entering the ETF via the Evaporator process condensate (19 evaporation campaigns from 2001 through 2019)	168 kg	10 kg

Table 3.1 Comparison of Previous Estimates to Revised Estimates of PCBs in SSTs, DSTs, and 242-A Evaporator

Projected evaporation campaigns from 2001 through 2009 involve one campaign per year, in which approximately one million gallons of aqueous tank waste will be evaporated over a period of approximately 30 calendar days. Projected evaporation campaigns from 2010 through 2019 involve one campaign per year, in which approximately 500,000 gallons of aqueous tank waste will be evaporated over a period of approximately 15 calendar days (CHG 2001b).

AIR DISPERSION MODEL

The next step in the risk evaluation process, following calculation of PCB emissions from the LWPF, is to determine the points of exposure for the Hanford Site workers and the public. The model used was the Industrial Source Complex 3 (ISC3) model, which is an EPA-approved model for calculating air dispersion of contaminants. The highest points of exposure for the potentially exposed Hanford Site worker range from 100 meters to 400 meters from the stacks at the Evaporator and the ETF, in the direction of the prevailing wind. The maximum point of exposure for the public, under the recently revised protocol for determining the maximum exposed individual, is the Hanford Site Boundary, approximately 19 to 20 km to the East Southeast of the LWPF. This location is at the Columbia River near the Energy Northwest facility in the 400 Area of the Hanford Site, as shown on Figure 3-1. All exposure scenarios for the air pathway are calculated separately for each LWPF unit and then added together to give a combined risk for the LWPF to each category of receptor (i.e., site workers and the public).

RISK CHARACTERIZATION

The third step in the risk evaluation process is quantification of risk to human health, based on the PCB emissions from the LWPF and the concentration of PCBs at the points of exposure for Hanford Site workers and the public. The primary health risk from exposure to PCBs is cancer. Carcinogens (known and suspected) are assigned a cancer slope factor (SF) by EPA, which is a measure of its potential to cause cancer in humans. The following formula is used to calculate the risk of excess incidence of cancer due to PCB exposure via the air pathway (EPA 2000):

$$R_i = LADD_{pot} \times SF$$

where:

R_i = excess individual lifetime cancer risk level (unitless);
$LADD_{pot}$ = lifetime average potential daily dose (mg/kg/day); and
SF = cancer potency slope factor $(\text{mg/kg/day})^{-1}$ [or kg-day/mg]

The application of reference dose (RfD) is typically used to estimate the risk of non-carcinogenic effects of a chemical (EPA 2000). EPA has not issued inhalation RfDs for any of the PCB Aroclors at this time, so there is no further attempt to quantify the non-carcinogenic effect of PCBs through the use of RfDs in this risk evaluation.

The assumptions regarding risk are similar to those used in the *"Double-Shell Tank System PCB Risk Assessment"* (CHG 2001a). The upper-bound SF of 0.4 kg-day/mg is assigned for PCBs, in accordance with the EPA's guidance manual for conducting PCB risk assessments (EPA 2000). Appendix 1, Section A.3.1 contains additional details regarding the approach used for calculation of risk to human health.

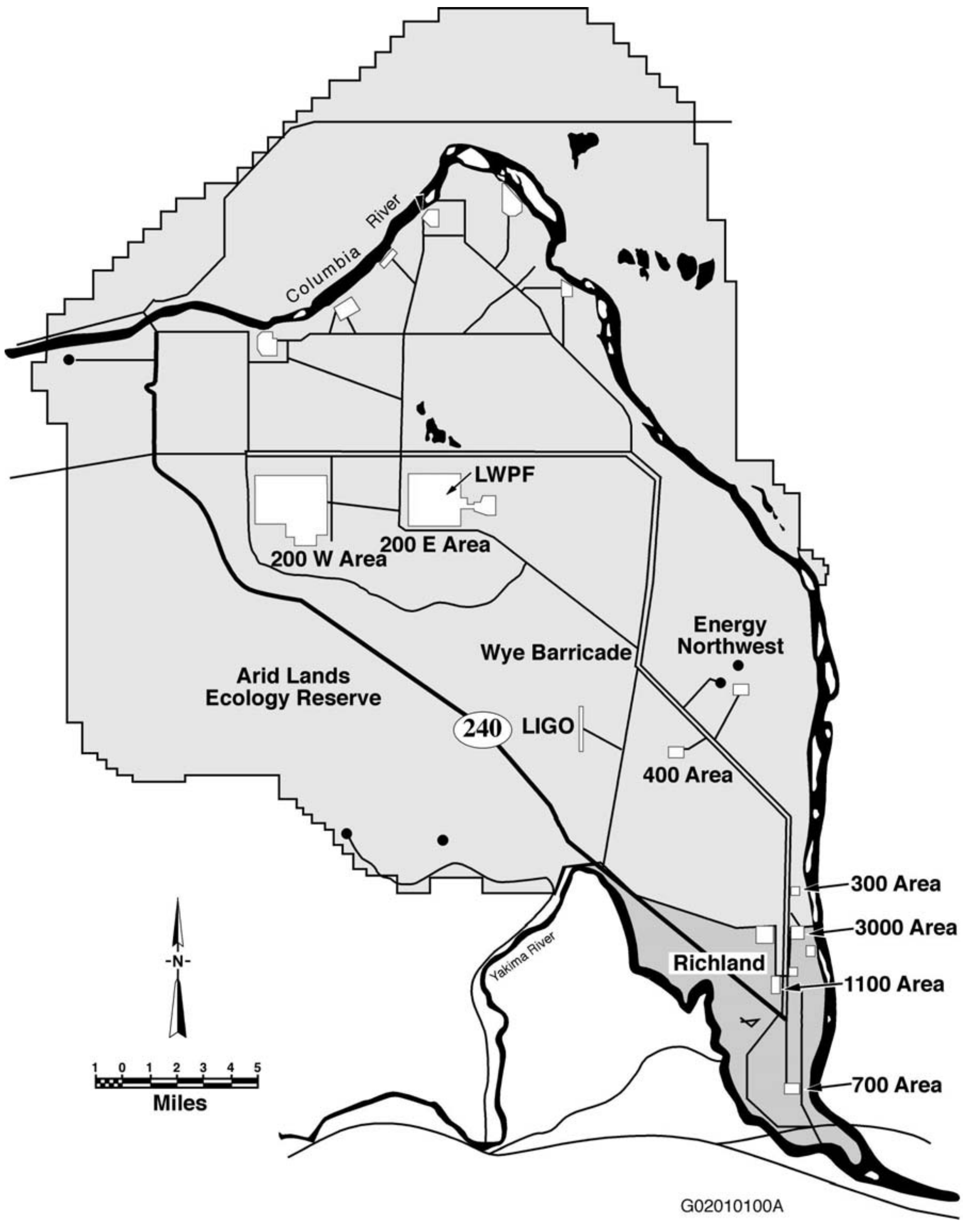

Figure 3-1 Hanford Site Map

3.1.2 Ecological Receptors

This section provides a discussion of how ecological risks from PCBs emitted by the LWPF to various receptors are evaluated.

PCB EMISSION MODEL

The model for estimating PCB air emissions from the LWPF via the air pathway applies to ecological receptors, as well as to humans. That model, as described in Section 3.1.1, is used to estimate exposure to various ecological receptors.

AIR DISPERSION MODEL

The ISC3 model for dispersion of PCBs from the LWPF to various ecological receptors is the same model used to estimate the concentration of PCBs in the air at the point of exposure for the Hanford Site workers. The exception is that the point of exposure for fish is the Columbia River, just south of the Energy Northwest facility.

RISK CHARACTERIZATION

The *"Double-Shell Tank PCB Risk Assessment"*, (CHG 2001a), Section 5.0, contains a complete, detailed description of the ecological receptors (invertebrates, fish, birds, mammals, amphibians/reptiles, and plants), including toxicity reference values (TRV). A species-specific TRV and an EPA TRV are used in this risk evaluation. The EPA TRV is consistently more conservative (i.e., has a lower value) than the species-specific TRV.

The LWPF is located adjacent to DST farms in the 200 East area of the Hanford Site, so the information from the *"Double-Shell Tank PCB Risk Assessment"* (CHG 2001a) regarding ecological receptors is valid for the LWPF, with the appropriate adjustments in the calculations for initial emission rates, duration of emissions, stack height and velocity, and other unit specific conditions that could influence exposure.

Impacts to ecological receptors are indicated in terms of the species-specific hazard quotient (HQ) and the EPA HQ for each species. Generally, an HQ greater than 1.0 indicates that there is a potential for an adverse impact to that species. The HQ is a function of the TRV for each species and the dose or exposure concentration. The TRV is the dose or exposure concentration at which no observed adverse effects to the species would be expected. The HQ for each ecological receptor evaluated is summarized in Section 3.2.2. The formula for calculating the HQ is as follows:

$$HQ = (\text{Dose or Exposure Concentration})/TRV \qquad \text{(CHG 2001a)}$$

The evaluation of risk to ecological receptors in Appendix 1 contains the calculations of risk, based on LWPF-specific conditions that influence exposure. Dose for each ecological receptor in this risk evaluation is derived by applying a ratio to the dose calculated for the same receptor in the *"Double-Shell Tank System PCB Risk Assessment"* (CHG 2001a). The ratio is a simple function of the grams of PCB per second release rate discharged to the air pathway. All other information regarding the ecological risk model (i.e., assumptions, model description, rationale, etc.) is contained in the *"Double-Shell Tank System PCB Risk Assessment"*, (CHG 2001a), Section 5.0.

3.2 RISK EVALUATION SUMMARY

This section summarizes the calculated risks associated with each of the scenarios described in Section 3.1.1, in terms of risk to human health and to the environment from PCBs that may be emitted to the air pathway from the LWPF. Appendix 1 contains the detailed modeling results and calculations from which this summary information is derived.

3.2.1 Human Health

The risk evaluation model results indicate that the LWPF can treat waste streams with significant PCB concentrations, with no unreasonable risk posed to the Hanford Site workers or to the public. The general standard that EPA uses for risk management decisions is that acceptable risk is in the range of one excess cancer incidence in a population of 10,000 people to 1,000,000 people. This is typically expressed as a risk in the range of 10^{-4} to 10^{-6}. For purposes of this risk evaluation, the more conservative risk value of 10^{-6} is considered the acceptable standard.

The calculated risks associated with varying concentrations of PCB in the wastewater received by the LWPF are shown in Tables 3.2 through 3.4 below. Table 3.5 is a roll-up or combined risk estimate for the Evaporator and the ETF (Configuration 3). Configuration 3 represents the scenario in which the greatest amount of PCB may be released to the air pathway from the ETF (see Section 2.3).

In addition to the risk calculations, as shown in Appendix 1 Tables A.3-3 through A.3-5, the PCB concentration in air at the point of exposure for the Hanford Site workers ranges from four to eight orders of magnitude lower than the concentration specified in the Occupational Safety and Health Administration (OSHA) permissible exposure levels, based on an eight-hour time-weighted average.

PCB Concentration in Aqueous Waste stream Received at the Evaporator	Risk of Excess Cancer Incidence	
	Site Workers (based on average emissions for 167 hours per year for 20 years)	**Public** (based on average emissions for 8,766 hours per year for 20 years)
0.2 μg/L	1.4×10^{-13}	1.1×10^{-13}
600 μg/L	4.3×10^{-10}	3.2×10^{-10}
6,000 μg/L	4.3×10^{-9}	3.2×10^{-9}

Table 3.2 Estimated Risk to Human Health from Exposure to PCBs from the 242-A Evaporator via the Air Pathway

PCB Concentration in Aqueous Waste stream Received at the ETF	Risk of Excess Cancer Incidence	
	Site Workers (based on average emissions for 1,700 hours per year for 20 years)	**Public** (based on average emissions for 8,766 hours per year for 20 years)
0.2 μg/L	4.2×10^{-13}	8.8×10^{-14}
600 μg/L	1.2×10^{-9}	2.6×10^{-10}
6,000 μg/L	1.2×10^{-8}	2.6×10^{-9}

Table 3.3 Estimated Risk to Human Health from Exposure to PCBs from the Effluent Treatment Facility (Configuration 1) via the Air Pathway

PCB Concentration in Aqueous Waste stream Received at the ETF	Risk of Excess Cancer Incidence	
	Site Workers (based on average emissions for 1,700 hours per year for 20 years)	**Public** (based on average emissions for 8,766 hours per year for 20 years)
0.2 μg/L	5.5×10^{-13}	1.1×10^{-13}
600 μg/L	1.6×10^{-9}	3.4×10^{-10}
6,000 μg/L	1.6×10^{-8}	3.4×10^{-9}

Table 3.4 Estimated Risk to Human Health from Exposure to PCBs from the Effluent Treatment Facility (Configuration 3) via the Air Pathway

PCB Concentration in Aqueous Waste stream Received at the LWPF	Risk of Excess Cancer Incidence	
	Site Workers (based on average emissions from the Evaporator for 167 hours per year for 20 years plus average emissions from ETF for 1,700 hours per year for 20 years)	**Public** (based on average emissions from the Evaporator for 8,766 hours per year for 20 years plus average emissions from ETF for 8,766 hours per year for 20 years)
0.2 μg/L	6.9×10^{-13}	2.2×10^{-13}
600 μg/L	2.0×10^{-9}	6.6×10^{-10}
6,000 μg/L	2.0×10^{-8}	6.6×10^{-9}

Table 3.5 Estimated Combined Risk to Human Health from Exposure to PCBs from the Evaporator and the ETF (Configuration 3) via the Air Pathway

3.2.2 Ecological Receptors

The *"Double-Shell Tank System PCB Risk Assessment"* (CHG 2001a), Section 5.0 includes a list of ecological receptors of potential concern (ERPC) that could be exposed to airborne PCB contamination from the Hanford Site 200 Area. Airborne PCB contamination from the LWPF in the Hanford Site 200 East Area (see Figure 3-1) would potentially impact the same receptors. The list of ERPCs and a summary of the impacts to each receptor is shown in Tables 3.6, 3.7, and 3.8.

The results of the ecological risk evaluation indicate that there will be no adverse impacts to the ecological receptors. An HQ value of greater than 1.0 indicates the potential for adverse effects related to exposure to PCBs from the LWPF via the air pathway for that species. The HQs for all species are at less than 1.0 when the species-specific TRVs are used. A few of the EPA HQ values in Tables 3.7 and 3.8 are greater than 1.0, indicating a slight risk to the meadow vole, the mink, and the white-tailed deer. These cases can be attributed to several conservatisms that are included in the model, as discussed in Appendix 1, Section A.3.7, (Uncertainty Analysis).

Ecological Receptor (Common Name)	Anticipated Total Dose	Species Specific TRV	EPA TRV	Species Specific HQ	EPA HQ
FISH Rainbow Trout / Steelhead	2.4×10^{-8} μg/L	2.1 μg/L	0.14 μg/L	1.2×10^{-8}	1.7×10^{-7}
BIRDS Red-tailed Hawk	2.0×10^{-8} mg/kg-day	1.73×10^{-1} mg/kg-day	7.2×10^{-2} mg/kg-day	1.1×10^{-7}	2.8×10^{-7}
Great Blue Heron	9.0×10^{-7} mg/kg-day	1.35×10^{-1} mg/kg-day	7.2×10^{-2} mg/kg-day	6.7×10^{-6}	1.2×10^{-5}
American Robin	2.0×10^{-6} mg/kg-day	4.2×10^{-1} mg/kg-day	7.2×10^{-2} mg/kg-day	4.6×10^{-6}	2.7×10^{-5}
MAMMALS White-tailed Deer	7.4×10^{-8} mg/kg-day	4.0×10^{-3} mg/kg-day	2.06×10^{-3} mg/kg-day	1.9×10^{-5}	3.6×10^{-5}
Mink	3.7×10^{-7} mg/kg-day	6.85×10^{-2} mg/kg-day	2.06×10^{-3} mg/kg-day	5.4×10^{-6}	1.8×10^{-4}
Meadow Vole	9.0×10^{-7} mg/kg-day	4.8×10^{-2} mg/kg-day	2.06×10^{-3} mg/kg-day	1.9×10^{-5}	4.4×10^{-4}
PLANTS Pigweed	1.3×10^{-6} mg/kg	40.0 mg/kg	10.0 mg/kg	3.3×10^{-8}	1.3×10^{-7}

Table 3.6 Impact to Ecological Receptors at 0.2 μg/L PCB in Wastewater Received at the Liquid Waste Processing Facilities.

Ecological Receptor (Common Name)	Anticipated Total Dose	Species Specific TRV	EPA TRV	Species Specific HQ	EPA HQ
FISH Rainbow Trout / Steelhead	7.0×10^{-5} µg/L	2.1 µg/L	0.14 µg/L	3.4×10^{-5}	5.0×10^{-4}
BIRDS Red-tailed Hawk	5.8×10^{-5} mg/kg-day	1.73×10^{-1} mg/kg-day	7.2×10^{-2} mg/kg-day	3.3×10^{-4}	8.0×10^{-4}
Great Blue Heron	2.6×10^{-3} mg/kg-day	1.35×10^{-1} mg/kg-day	7.2×10^{-2} mg/kg-day	1.9×10^{-2}	3.6×10^{-2}
American Robin	5.7×10^{-3} mg/kg-day	4.2×10^{-1} mg/kg-day	7.2×10^{-2} mg/kg-day	1.4×10^{-2}	7.9×10^{-2}
MAMMALS White-tailed Deer	2.2×10^{-4} mg/kg-day	4.0×10^{-3} mg/kg-day	2.06×10^{-3} mg/kg-day	5.4×10^{-2}	1.1×10^{-1}
Mink	1.1×10^{-3} mg/kg-day	6.85×10^{-2} mg/kg-day	2.06×10^{-3} mg/kg-day	1.6×10^{-2}	5.3×10^{-1}
Meadow Vole	2.6×10^{-3} mg/kg-day	4.8×10^{-2} mg/kg-day	2.06×10^{-3} mg/kg-day	5.5×10^{-2}	1.3
PLANTS Pigweed	3.9×10^{-3} mg/kg	40.0 mg/kg	10.0 mg/kg	9.7×10^{-5}	3.9×10^{-4}

Table 3.7 Impact to Ecological Receptors at 600 µg/L PCB in Wastewater Received at the Liquid Waste Processing Facilities.

Ecological Receptor (Common Name)	Anticipated Total Dose	Species Specific TRV	EPA TRV	Species Specific HQ	EPA HQ
FISH Rainbow Trout / Steelhead	7.0×10^{-4} µg/L	2.1 µg/L	0.14 µg/L	3.4×10^{-4}	5.0×10^{-3}
BIRDS Red-tailed Hawk	5.8×10^{-4} mg/kg-day	1.73×10^{-1} mg/kg-day	0.072 mg/kg-day	3.3×10^{-3}	8.0×10^{-3}
Great Blue Heron	2.6×10^{-2} mg/kg-day	1.35×10^{-1} mg/kg-day	0.072 mg/kg-day	1.9×10^{-1}	3.6×10^{-1}
American Robin	5.7×10^{-2} mg/kg-day	4.2×10^{-1} mg/kg-day	0.072 mg/kg-day	1.4×10^{-1}	7.9×10^{-1}
MAMMALS White-tailed Deer	2.2×10^{-3} mg/kg-day	4.0×10^{-3} mg/kg-day	2.06×10^{-3} mg/kg-day	5.4×10^{-1}	1.1
Mink	1.1×10^{-2} mg/kg-day	6.85×10^{-2} mg/kg-day	2.06×10^{-3} mg/kg-day	1.6×10^{-1}	5.3
Meadow Vole	2.6×10^{-2} mg/kg-day	4.8×10^{-2} mg/kg-day	2.06×10^{-3} mg/kg-day	5.5×10^{-1}	13.0
PLANTS Pigweed	3.9×10^{-2} mg/kg	40 mg/kg	10 mg/kg	9.7×10^{-4}	3.9×10^{-3}

Table 3.8 Impact to Ecological Receptors at 6,000 µg/L PCB in Wastewater Received at the Liquid Waste Processing Facilities.

4.0 MANAGEMENT OF LIQUID AND SOLID WASTE STREAMS

4.1 LIQUID WASTE

The only pathway in which liquids from the LWPF enter the environment is the discharge of treated effluent to the SALDS. The liquid waste is otherwise fully contained in the LWPF and has no potential for release to the environment during normal operations. Therefore, this RBDA application does not include an evaluation of the impact to human health or the environment from the aqueous waste while in the LWPF or from the discharge of treated effluent to the SALDS, as all treated effluent will contain less than 0.5 μg/L PCB at the time of discharge.

The treatment process at the ETF can effectively reduce any expected concentration of total PCBs to less than 0.5 μg/L, which is the standard at which the effluent may be released without further restriction under the TSCA, as specified at §761.30(u)(3). The EPA developed the standard of 0.5 μg/L total PCB on the basis of the maximum contaminant level (MCL) of 0.5 μg/L, specified in the Safe Drinking Water Act. PCBs are considered a probable human carcinogen (classification B2), so the maximum contaminant level goal is 0 μg/L. The EPA based the MCL on the practical quantitation limit of 0.5 μg/L and a lifetime risk of excess cancer incidence of 1×10^{-4}. The August 1993 Delisting Petition (DOE 1993b) provides the detailed information on the capability of the UV oxidation system at ETF to effectively reduce extremely high PCB concentrations to less than 0.5 μg/L, based on a decontamination factor of 11,600. Section 2.3 provides more detailed information on the treatment capabilities of the ETF.

The State Waste Discharge Permit (Ecology 2000b) for disposing treated effluent to the SALDS does not specifically address PCBs; however, Ecology has approved receipt of wastewater containing up to 150 μg/L PCBs at the LERF. If concentrations of total PCBs are found above the 150 μg/L in the influent, DOE shall provide Ecology with information as necessary to modify the concentration of PCBs that can be accepted in aqueous waste influent to be consistent with the concentration that can be received through the EPA's approval of this RBDA application

4.2 SOLID WASTE

This RBDA application does not include a risk evaluation for any solid wastes generated at the LWPF. Solid wastes that could contain PCBs are generated at various points in the LWPF and may consist of such items as contaminated HEPA or GAC filters, spent filter media, and RO membranes. All of these items are managed as radioactive/dangerous mixed waste and are transported to authorized facilities on the Hanford Site for storage, treatment, or disposal.

Additionally, the thin-film drying process at the ETF generates a residue or thin-film drying powder that is currently designated as a mixed waste. The ETF staff will continue to manage this powder as a mixed waste and will containerize and ship the powder to the Central Waste Complex or other authorized facility at the Hanford Site. A delisting petition is currently in review by Ecology. Upon approval by Ecology, the thin-film drying powder would be delisted as a dangerous waste or mixed waste. The powder was recently analyzed for PCBs, following treatment of process condensate generated during the September 2000 tank farm evaporation campaign and was found to contain no PCBs above the MDL of 0.2 μg/kg (or 0.2 ppb) per Aroclor. All PCB analyses for solids are reported on a dry weight basis, in accordance with §761.274. This is far below the threshold of 50 ppm, the level at which TSCA storage requirements of §761.50 would be triggered. The thin-film drying powder will be sampled and analyzed in accordance with the delisting petition requirements. If a solid waste should be found to exceed a total PCB concentration of 50 ppm, the waste will be stored and managed in a manner that is fully compliant with §761.50.

5.0 PROPOSED PCB CONCENTRATIONS AND OPERATING CONDITIONS

The information contained in this RBDA application supports the position that aqueous wastes with total PCB concentrations greater than 0.5 µg/L can be received, stored, and treated at the LWPF, and that the management of such aqueous waste can be performed without posing an unreasonable risk of injury to health or the environment. Operation of the Evaporator, the LERF, and the ETF in accordance with existing permits, approvals, and procedures provides the primary level of assurance that liquid PCB remediation waste can be managed without presenting an unreasonable risk.

In certain cases, additional operational steps are advisable to address PCBs and specific types of waste streams. Sections 5.1 and 5.2 include additional proposed operational safeguards that will be implemented at each facility when that facility is managing PCB remediation waste. These proposed operational safeguards will serve as “defense-in-depth” measures to ensure that the potential impact to human health and the environment from treatment of PCBs at the LWPF is maintained.

The increased levels of PCBs that can be accepted at each of the facilities when the operating conditions are in effect are also included in Sections 5.1 and 5.2. These concentrations of total PCBs in the incoming wastewater are based on the results of this risk evaluation and are set at levels at which discharge of PCBs to the air pathway from the LWPF will not cause an unacceptable risk to human health or the environment. These levels are also set to ensure the ETF can treat PCBs to a level of less than 0.5 µg/L in the treated effluent prior to discharge to the SALDS.

5.1 242-A EVAPORATOR

5.1.1 Proposed Maximum PCB Concentrations for the Evaporator

Upon approval of this RBDA by the EPA, the DOE may receive PCB remediation waste at the Evaporator at a maximum concentration of 6,000 µg/L (6.0 mg/L) total PCB.

5.1.2 Proposed Operating Conditions for the Evaporator

a. The DOE shall comply with all current requirements of its RCRA Permit (Ecology 2000a) with respect to management and treatment of PCB remediation waste at the Evaporator. Such conditions include the following, which are verbatim conditions from the RCRA Permit:

Permit Condition 4.2.2 Process Vents – Demonstrating Compliance
This section outlines how the 242-A Evaporator complies with the requirements of 40 CFR 264, Subpart AA, including a discussion of the basis for meeting the organic emission limits, calculations demonstrating compliance, and conditions for reevaluating compliance.

Permit Condition 4.2.2.1 Basis for Meeting Limits/Reductions
The TSD units at the Hanford Facility subject to 40 CFR 264, Subpart AA meet the organic air emission limits of 1.4 kilograms per hour and 2.8 megagrams per year, established in 40 CFR 264.1032, by the design of the facility. The 242-A Evaporator and the other TSD units collectively can meet these standards without the use of air pollution control devices.

Permit Condition 4.2.2.2 Demonstrating Compliance
Process vent organic air emissions are controlled by establishing limits for acceptance of waste at the 242- A Evaporator. Before startup of each campaign, the waste to be processed is sampled in the DST System to determine the organic content. If the concentrations of organic constituents are less than the limits in the waste analysis plan (Chapter 3.0, Appendix 3A), the waste can be processed, provided the Hanford Facility will not exceed 1.4 kilograms per hour and 2.8 megagrams per year. The waste acceptance limits in the waste analysis plan are based on equilibrium calculations and assumptions given in *Organic Emission Calculations for the 242-A Evaporator Vessel Vent System* (WHC 1996). The calculation to determine organic emissions consists of the following steps:

1. Determine the emission rate of each candidate feed tank organic constituent by multiplying the constituent concentration by the corresponding partition factor in *Organic Emission Calculations for the 242-A Evaporator Vessel Vent System* (WHC 1996).

2. Sum the emission rates of all organic constituents to determine the emission rate for the candidate feed tank. The maximum emission rate for the campaign is the rate from the candidate tank with the greatest emission rate.

3. Determine the total amount of emission during the campaign by using operating time and a weighted average emission rate, based on the volume of each candidate feed tank processed.

The organic emission rates and quantity of organics emitted during the campaign are determined using these calculations and are included in the operating record for each campaign, as required by 40 CFR 264.1035. The Hanford Facility has a system to ensure organic emissions from units subject to 40 CFR 264, Subpart AA are less than the limits of 1.4 kilograms per hour and 2.8 megagrams per year.

Records documenting total organic emissions are available for Ecology review on request.

Permit Condition 4.2.2.3 Reevaluating Compliance with Subpart AA Standards
Calculations to determine compliance with Subpart AA will be reviewed when any of the following conditions occur at the 242-A Evaporator:

- Changes in the configuration or operation that affect the assumptions given in *Organic Emission Calculations for the 242-A Evaporator Vessel Vent System* (WHC 1996).
- Annual operating time exceeds 182 days.

b. DOE will require ORP to determine the concentration of PCBs in its tank waste prior to shipment to the 242-A Evaporator and the concentration shall be documented in the LWPF operating record. If total PCB concentrations in tank waste exceed the limit specified at Section 5.1.1, DOE shall not accept such waste at the Evaporator, unless the EPA specifically approves receipt of such waste.

c. DOE shall add PCBs as a constituent of concern to be addressed when the Evaporator RCRA Closure Plan is implemented and shall demonstrate that PCBs have been removed to levels specified at §761.79, as part of RCRA clean closure.

5.2 LERF and ETF

5.2.1 Proposed Maximum PCB Concentrations for LERF and ETF

Upon approval of this RBDA by the EPA, the DOE may receive PCB remediation waste at the LERF or the ETF from Hanford Site aqueous waste generators at a maximum concentration of 6,000 µg/L (6.0 mg/L) total PCB.

5.2.2 Proposed Operating Conditions for LERF and ETF

a. DOE shall comply with all current requirements of its RCRA permit (Ecology 2000a) with respect to management of PCB remediation waste at the LERF and the ETF. Such permit conditions include the following, which are verbatim conditions from the RCRA Permit:

Permit Condition 4.6.2 Process Vents - Demonstrating Compliance

This section outlines how the ETF complies with the requirements and includes a discussion of the basis for meeting the organic emissions limits, calculations demonstrating compliance, and conditions for re-evaluation.

Permit Condition 4.6.2.1 Basis for Meeting Limits/Reductions

The 242-A Evaporator and the 200 Area ETF are currently the only operating TSD units that contribute to the Hanford Facility volatile organic emissions under 40 CFR 264, Subpart AA. The combined release rate is currently well below the threshold of 1.4 kilograms per hour or 2.8 megagrams per year of volatile organic compounds [General Information Portion (DOE/RL-91-28)]. As a result, the ETF meets these standards without the use of air pollution control devices.

The amount of organic emissions could change as waste streams are changed, or TSD units are brought online or are deactivated. The organic air emissions summation will be re-evaluated periodically as condition warrants. Operations of the TSD units operating under 40 CFR 264, Subpart AA, will be controlled to maintain Hanford Facility emissions below the threshold limits or pollution control device(s) will be added, as necessary, to achieve the reduction standards specified under 40 CFR 264, Subpart AA.

Permit Condition 4.6.2.2 Demonstrating Compliance

Calculations to determine organic emissions are performed using the following assumptions:

- Maximum flow rate from LERF to ETF is 568 liters per minute.
- Emissions of organics from tanks and vessels upstream of the UV/OX process are determined from flow and transfer rates given in *Clean Air Act Requirements, WAC 173-400, As-built Documentation, Project C-018H, 242-A Evaporator/PUREX Plant Process Condensate Treatment Facility* (Adtechs 1995).
- UV/OX reaction rate constants and residence times are used to determine the amount of organics which are destroyed in the UV/OX process. These constants are given in *200 Area Effluent Treatment Facility Delisting Petition* (DOE/RL 1992).
- All organic compounds that are not destroyed in the UV/OX process are assumed to be emitted from the tanks and vessels into the vessel offgas system.
- No credit for removal of organic compounds in the vessel offgas system carbon adsorber unit is taken. The activated carbon absorbers are used if required to reduce organic emissions.

The calculation to determine organic emissions consists of the following steps:

1. Determine the quantity of organics emitted from the tanks or vessels upstream of the UV/OX process, using transfer rate values

2. Determine the concentration of organics in the waste after the UV/OX process using UV/OX reaction rates and residence times. If the ETF is configured such that the UV/OX process is not used, a residence time of zero is used in the calculations (i.e., none of the organics are destroyed)

3. Assuming all the remaining organics are emitted, determine the rate which the organics are emitted using the feed flow rate and the concentrations of organics after the UV/OX process

4. The amount of organics emitted from the vessel offgas system is the sum of the amount calculated in steps 1 and 3.

The organic emission rates and quantity of organics emitted during processing are determined using these calculations and are included in the ETF operating record.

Permit Condition 4.6.2.3 Reevaluating Compliance with Subpart AA Standards

Calculations to determine compliance with Subpart AA will be reviewed when any of the following conditions occur at the ETF:

- Changes in the maximum feed rate to the ETF (i.e., greater than the 568 liters per minute flow rate)

- Changes in the configuration or operation of the ETF that would modify the assumptions given in Section 4.6.2.2 (e.g., taking credit for the carbon adsorbers as a control device)

- Annual operating time exceeds 310 days.

Permit Condition 4.6.3 Applicability of Subpart CC Standards

The air emission standards of 40 CFR 264, Subpart CC apply to tank, surface impoundment, and container storage units that manage wastes with average volatile organic concentrations equal to or exceeding 500 parts per million by weight, based on the hazardous waste composition at the point of origination (61 FR 59972). However, TSD units that are used solely for management of mixed waste are exempt. Mixed waste is managed at the ETF and LERF and dangerous waste also could be treated and stored at these TSD units.

TSD owner/operators are not required to determine the concentration of volatile organic compounds in a hazardous waste if the wastes are placed in waste management units that employ air emission controls that are in compliance with the Subpart CC standards. Therefore, the approach to Subpart CC compliance at the ETF and LERF is to demonstrate that the ETF and LERF meet the Subpart CC control standards (40 CFR 264.1084 - 264.1086).

Permit Condition 4.6.3.1 Demonstrating Compliance with Subpart CC for Tanks

Since the ETF tanks already have process vents regulated under 40 CFR 264, Subpart AA (WAC 173-303-690), they are exempt from Subpart CC [40 CFR 264.1080(b)(8)].

Permit Condition 4.6.3.2 Demonstrating Compliance with Subpart CC for Containers

Container Level 1 and Level 2 standards are met at the ETF by managing all dangerous and/or mixed wastes in U.S. Department of Transportation containers [40 CFR 264.1086(f)]. Level 1 containers are those that store more than 0.1 cubic meters and less than or equal to 0.46 cubic meters. Level 2 containers are used to store more than 0.46 cubic meters of waste which are in "light material service". Light material service is defined where a waste in the container has one or more organic constituents with a vapor pressure greater than 0.3 kilopascals at 20 C, and the total concentration of such constituents is greater than or equal to 20 percent by weight.

The monitoring requirements for Level 1 and Level 2 containers include a visual inspection when the container is received at the ETF and when the waste is initially placed in the container. Additionally, at least once every 12 months when stored onsite for 1 year or more, these containers must be inspected.

If compliant containers are not used at the ETF, alternate container management practices are used that comply with the Level 1 standards. Specifically, the Level 1 standards allow for a "container equipped with a cover and closure devices that form a continuous barrier over the container openings such that when the cover and closure devices are secured in the closed position there are no visible holes, gaps, or other open spaces into the interior of the container. The cover may be a separate cover installed on the container...or may be an integral part of the container structural design...." [40 CFR 264.1086(c)(1)(ii)]. An organic-vapor-suppressing barrier, such as foam, may also be used [40 CFR 264.1086(c)(1)(iii)]. Section 4.3 provides detail on container management practices at the ETF.

Container Level 3 standards apply when a container is used for the "treatment of a hazardous waste by a waste stabilization process" [40 CFR 264.1086(2)]. Because treatment of hazardous waste in containers, by stabilization, is not provided at the ETF, these standards do not apply.

Permit Condition 4.6.3.3 Demonstrating Compliance with Subpart CC for Surface Impoundments

The Subpart CC emission standards are met at LERF through the use of a floating membrane cover that is constructed of very-low-density polyethylene that forms a continuous barrier over the entire surface area [40 CFR 264.1085(c)]. This membrane has both organic permeability properties equivalent to a high-density polyethylene cover and chemical/physical properties that maintain the material integrity for the intended service life of the material. The additional requirements for the floating cover at the LERF have been met (Section 4.5.2.4).

b. DOE shall require all aqueous waste generators to determine whether PCBs may be present in the waste streams to be sent to the LERF or the ETF. If PCBs are known or expected to be present, the concentration of PCBs in the waste stream shall be determined prior to shipment to the LERF or the ETF and the concentration shall be documented in the LWPF operating record.

c. DOE shall add PCBs as a constituent of concern to be addressed when the LERF/ETF RCRA Closure Plan is implemented and shall demonstrate that PCBs have been removed to levels specified at §761.79, as part of RCRA clean closure.

d. If concentrations of total PCBs are found above the 150 μg/L in the influent, DOE shall provide Ecology with information as necessary to modify the concentration of PCBs that can be accepted in aqueous waste influent to be consistent with the concentration that can be received through the EPA's approval of this RBDA application (see Section 5.2.1).

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6.0 CONCLUSION

There are a number of factors that provide a weight of evidence that the presence of PCBs in the various waste streams that enter the LWPF do not present a credible threat to human health or the environment. These factors are discussed throughout this RBDA application and are summarized below.

Risk evaluation results in support of this RBDA application – The results of this risk evaluation indicate that impacts to human health and the environment from managing and treating PCB remediation waste at the LWPF is well within the range of acceptable risk. The estimated impact to Hanford Site workers, in terms of excess cancer incidence attributed to PCBs in the air pathway under worst-case conditions is 2.0×10^{-8} and the estimated risk to the public (MEI) is 6.6×10^{-9}, as shown in Table 3.5. The Hazard Quotients for ecological receptors are generally below 1.0, which is the threshold at which adverse effects may be expected.

Physical properties of PCBs – PCBs can exist in aqueous solutions only to the extent allowed by its solubility in water. The various PCB Aroclors are relatively insoluble in water (range of 0.05 mg/L to 0.45 mg/L), at standard temperature and pressure (EPA 2000).

Available PCB data for incoming waste – To date, PCBs have not been detected in any of the waste streams entering the LWPF. Although this does not ensure that waste streams received by the LWPF in the future will not contain measurable amounts of PCBs, the existing data leads to a reasonable conclusion that if future waste streams should be found to contain PCBs at concentrations greater than 0.5 µg/L, the concentrations would be expected to be relatively low, as opposed to concentrations that would approach the solubility limits.

Treatment capability for liquid waste streams – The DOE's 1993 Delisting Petition (DOE 1993b) for the ETF demonstrates a very robust system for treatment of PCBs in the standard operating configuration. The DF of 11,600 for a PCB surrogate material leads to the conclusion that a concentration of up to 5,800 µg/L (5.8 mg/L) total PCBs in a waste stream could be effectively reduced to 0.5 µg/L in the ETF treatment process. The ability to recycle the treated waste through the UV oxidation step, if necessary, provides even greater treatment capability.

Air emission data from previous Evaporator risk evaluation – The risk evaluation for the 2001-01 Evaporator campaign (FH 2001a), approved by EPA on February 15, 2001, and the post evaporation campaign follow-up report (RL 2001) indicated that only five to seven percent of the available PCBs from DSTs would be discharged from the Evaporator to the air pathway. Nearly all the remaining PCBs would enter the process condensate and be treated in the ETF.

Conclusions of DST model of PCB distribution – The Draft "*Double Shell Tank System Model of PCB Distribution in the Liquid Waste Handling System"* (CHG 2001b), provides an estimate of the amount of PCBs that will be available to enter the Evaporator and the amount of PCBs that will be discharged to the air pathway from the Evaporator through the year 2019. Approximately 1.0 kg of PCBs is expected to be discharged from the Evaporator stack over the 18-year period and approximately 10 kg of PCBs are expected to be routed to the ETF in the process condensate over the same 18-year period (see Table 3.1). These estimates, which are lower than earlier estimates, are based on actual concentrations of PCBs recently found in tank waste solids. The MDLs for these recent samples were significantly lower than the MDLs previously achievable.

Normal operating conditions for the LWPF – The Evaporator, the LERF, and the ETF all operate under the strict provisions of a RCRA permit. The waste management practices required under this permit provide a high level of assurance that liquid wastes are managed in a safe and compliant manner. Technical operations at the LWPF, as required by the RCRA permit, the authorization basis, and implementing procedures, do not require additional modification to accommodate treatment of PCBs. The RCRA permit also contains a closure plan that indicates all LWPF units will be "clean closed" at the time of facility closure. Clean closure for all known RCRA constituents, including organics, will assure that any liquid and non-liquid PCBs are also removed at the time of closure.

Organic vapor discharges from the LWPF that are subject to 40 CFR 264 Subpart AA are governed by the RCRA Permit. Additionally, inorganic toxic air releases from the ETF and the LERF are regulated by the Hanford Site Air Operating Permit. These permitting mechanisms provide additional assurance that the facilities will be operated in a safe and compliant manner. Although PCBs are not specifically monitored, the physical controls installed at the points of air release from the ETF and the LERF will be effective at removing small concentrations of PCBs before they can enter the ambient air.

Additional operating conditions further minimize risk – Operating conditions specified in Section 5.0 are a combination of existing requirements governed by permit conditions and new requirements that the DOE and its contractor will implement to provide further assurance or "defense-in-depth" that management of PCBs at the LWPF will not result in an unacceptable risk to human health or the environment.

The presence of PCBs in aqueous waste to be received and treated by the LWPF does not present any new technical issues; that is, additional steps or modifications to the treatment process, are not required to treat higher concentrations of PCBs. Upon EPA's approval of this RBDA application, the presence of PCBs in the aqueous waste streams will no longer have a potential impact to schedules for treatment of Hanford Site aqueous waste streams at the LWPF.

7.0 REFERENCES

Note: This reference list contains references from both the Application and Appendix 1.

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CHG 2001b	"*Double Shell Tank System Model of PCB Distribution in the Liquid Waste Handling System"*, RPP-9495, REVISION DRAFT, CH2M Hill Hanford Group, issued for review December 2001.
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